THE UNIVERSITY OF ALABAMA

INVITATION FOR BID

ATTENTION: This is not an order. Read all instructions and terms and conditions carefully.

INVITATION NO.:	T054075
Issue Date:	03/20/2014
Title:	Spark-Ignited Generator Set and Automatic Transfer Switch for Capstone Village
Buyer:	Tara Nicholas
Phone:	(205) 348-5035
Email:	tnicholas@fa.ua.edu

RETURN ALL COPIES OF BIDS TO:
THE UNIVERSITY OF ALABAMA
PURCHASING DEPARTMENT
(Street Address) 1101 Jackson Ave Suite 3000
Tuscaloosa, Alabama 35401
OR
(Mailing Address) Box 870130
Tuscaloosa, Alabama 35487
PHONE: (205)348-5230 FAX: (205) 348-8706

Bid Responses may NOT be faxed or emailed.

IMPORTANT: SEALED BIDS MUST BE RECEIVED BY 04/04/2014 @ 2:00 P.M. CST TIME

Bid number and opening date must be clearly marked on the outside of all bid packages.

1. Pursuant to the provisions of the State of Alabama Competitive Bid Law, Section 41-16-20 and/or 39-2, rules and regulations adopted there under sealed bids will be received on the items noted herein by The University of Alabama Purchasing Department until the date and time stated above. In accordance with Alabama State Bid Law Section 41-16-27, where applicable, the University reserves the right to enter into negotiations within thirty (30) days of the bid opening.
2. The University's General Terms and Conditions and Instructions to Bidders, apply to this Solicitation and shall become a part of any contract issued hereunder.
3. For purposes of this Solicitation, the Solicitation documents shall consist of the following components:
   a) Invitation for Bid and any Addenda; b) General Terms and Conditions; c) Instructions to Bidders
   In the event that any provision of the component parts of the Solicitation conflicts with any provision of any other component parts, the component part first enumerated shall govern.
4. This Agreement and any disputes hereunder shall be governed by the laws of the State of Alabama without regard to conflict of law principles.

CERTIFICATION PURSUANT TO ACT NO. 2006-557

Alabama law (section 41-4-116, code of Alabama 1975) provides that every bid submitted and contract executed shall contain a certification that the vendor, contractor, and all of its affiliates that make sales for delivery into Alabama or leases for use in Alabama are registered, collecting, and remitting Alabama state and local sales, use, and/or lease tax on all taxable sales and leases in Alabama. **By submitting a response to this solicitation, the bidder is hereby certifying that they are in full compliance with Act No. 2006-557**; they are not barred from bidding or entering into a contract pursuant to 41-4-116, and acknowledges that The University of Alabama may declare the contract void if the certification is false.

DISCLOSURE STATEMENT

1. If you or any owner, officer, partner, board or director member, employee, or holder of more than 5% of the fair market value of your firm or any member of their households is an employee of The University of Alabama, this information must be included in your solicitation response. Failure to disclose this information in your response may result in the elimination of your proposal from evaluation.
2. If you or any owner, officer, partner, board or director member, employee, or holder of more than 5% of the fair market value of your firm or any member of their households is an employee of The University of Alabama; and you or your firm is awarded a contract as a result of this solicitation, then within ten (10) days after the contract is entered into, you agree to file a copy of that contract with the State of Alabama Ethics Commission in accordance with Code of Alabama, Section 36-25-11 and upon request by the University furnish evidence of such filing.
3. By accepting payments agreed to in any purchase order resulting from this bid, Contractor certifies that to its knowledge no University employee or official, and no family members of a University employee or official, will receive a benefit from these payments, except as has been previously disclosed, in writing, to the University on the Disclosure Statement of Relationship Between Contractors/Grantees and Employees/Officials of The University of Alabama.

AUTHENTICATION OF BID AND STATEMENT OF NON-COLLUSION AND NON-CONFLICT OF INTEREST

I hereby swear (or affirm) under the penalty for false swearing as provided in Code of Alabama 6-5-180 that

1. In accordance with Code of Alabama Section 41-16-25, amended 1975 that the attached response has been arrived at independently and has been submitted without collusion with, and without any agreement, understanding or planned common course of action with, any other vendor of materials, supplies, equipment or services described in the Invitation for Bids, designed to limit independent bidding or competition;
2. The contents of the bid or bids have not been communicated by the bidder or its employees or agents to any person not an employee or agent of the bidder or its surety on any bond furnished with the bid or bids and will not be communicated to any such person prior to the official opening of the bid or bids.
3. The bidder is legally entitled to enter into contracts with The University of Alabama and is not in violation of any prohibited conflict of interest, including those prohibited by the Code of Alabama 13A-10-62, as amended 1975.
4. I have fully informed myself regarding the accuracy of the statement made above.

THIS AREA MUST BE COMPLETED

DELIVERY AFTER RECEIPT OF ORDER:	**NAME OF COMPANY:**	**PHONE:**
FEDERAL EMPLOYER ID NO.:	**ADDRESS:**	**FAX:**
PAYMENT TERMS:	**ADDRESS:**	**E-MAIL:**
SHIPPING TERMS: **F.O.B. DESTINATION–PREPAID AND ALLOWED**	**CITY, STATE & ZIP CODE:**	**DATE:**
QUOTE VALID UNTIL:	**SIGNATURE:**	**Typed/Printed Name of Signor**

SIGNATURE REQUIRED: This bid cannot be considered valid unless signed and dated by an authorized agent of the bidder. Type or print the information requested in the spaces provided.

INVITATION FOR BID

The University of Alabama requests sealed bids as per attached general and technical specifications or equal unless otherwise specified in the Special Conditions.

All Bidders submitting a bid must read all specifications carefully and respond accordingly. Failure to do so may eliminate your bid from consideration due to non-compliance.

1.0 GENERAL SPECIFICATIONS

1.1 Any contract resulting from this request will be made available to other eligible entities. This may include but is not limited to; The University of Alabama System, comprised of The University of Alabama; The UAB Enterprise, consisting of The University of Alabama at Birmingham, the UAB Health System and their related foundations and affiliates , and The University of Alabama in Huntsville, Huntsville, AL; and other state entities. Contracts resulting from the award of this request cover shipments by any entity listed above. Each entity will generate its own purchase orders, payments, etc. and delivery must be made according to the instructions on the purchase order.

The thrust of the contract is to obtain greater volume price discounts by combining the volume of purchases from participating entities within the State of Alabama.

1.2 All bid responses, technical information and any other attachments furnished to The University of Alabama in response to this request for quotation must be submitted in duplicate (THE ORIGINAL BID AND ATTACHMENTS WITH ORIGINAL SIGNATURE AND ONE EXACT COPY OF THE ENTIRE BID RESPONSE). Bidders who fail to follow this format may be disqualified from the evaluation and award phase of this bid.

1.3 The stated requirements appearing elsewhere in this solicitation shall become a part of the terms and conditions of any resulting contract. Any deviations there from must be specifically defined. If accepted by the University, the deviations shall become part of the contract, but such deviations must not be in conflict with the basic nature of this solicitation.

Note: Bidders shall not submit their standard terms and conditions or purchase order terms as exceptions to or modification of the terms and conditions of this solicitation. Each exception to or modification of a University term and condition shall be individually listed by the bidder. Failure to follow this instruction may result in the determination that a bid submission is non-responsive to a solicitation and the rejection of that bid.

1.4 The issuance of a University Purchase Order (P#) or a signed Contract document is required to constitute a contract between the successful Bidder and the University which shall bind the successful Bidder to furnish and deliver the commodities ordered at the prices, terms and conditions quoted and in accordance with the specifications of this Solicitation as well as the terms and conditions of the University's Purchase Order or Contract. No shipments are to be made to The University of Alabama without the issuance of a Purchase Order (P#). (Bidders are not to accept or ship items against a requisition number "R" #.)

1.5 Any questions concerning these specifications should be directed to the Buyer listed on the signature page.

1.6 No department, school or office at the University has the authority to solicit or receive official Solicitations nor authorize Solicitation or Contract changes other than the Purchasing Department. All solicitations are issued under the direct supervision of the Associate Director for Purchasing and in complete accordance with the State of Alabama Bid Law, Section 41-16-20 and University policies and procedures.

1.7 The terms and conditions included in this Solicitation along with any addenda, any University contract and/or University purchase order(s) issued referencing this Solicitation, the University's General Terms and Conditions, Instructions to Bidders shall constitute the entire and exclusive Contract between the University and the successful Bidder.

1.8 **State of Alabama Immigration Law Compliance**

Compliance Notice.

By submitting a proposal to this RFP, a Respondent agrees that it will fully comply with the State of Alabama Immigration Law (Act 2011-535), as amended. A Respondent also shall enroll in the E-Verify Program prior to performing any work, or continuing to perform any on-going work, and shall remain enrolled throughout the entire course of its performance of the contract awarded pursuant to this RFP. By signing this contract, the contracting parties affirm, for the duration of the agreement, that they will not violate federal immigration law or knowingly employ, hire for employment, or continue to employ an unauthorized alien within the state of Alabama. Furthermore, a contracting party found to be in violation of this provision shall be deemed in breach of the agreement and shall be responsible for all damages resulting therefrom." To the fullest extent permitted by law, the Contractor shall defend, indemnify and hold harmless the University from any and all losses, consequential damages, expenses (including but not limited to, attorneys' fees), claims, suits, liabilities, fines, penalties, and any other costs arising out of or in any way related to Contractor's failure to fulfill its obligations contained in this paragraph or contained in the Alabama Immigration Law (Act 2011-535), as amended.

State of Alabama Immigration Law (Act 2011-535)

The successful contractor will be required to provide written certification they are in compliance with Section 9 of the State of Alabama Immigration Law (Act 2011-535).
One of the two required documents must be submitted prior to issuance of a University contract or purchase order. . Please complete and submit the form or document that applies to your company.

Complete this document only, if your company is not located in Alabama and your company does not have employees or subcontractors that work in the State of Alabama.

- Certification of Compliance and affidavit forms included with this solicitation (*see Appendix – Certification of Compliance*)

Complete the E-Verify document online, if your company is located in Alabama or your company has employees working in Alabama

- Contractor's one-page E-verify Employment Eligibility Verification form (*see example included in Appendix - E-Verify*).

If you have previously enrolled in E-Verify, follow these instructions:

- Log onto www.uscis.gov/everify
- Click "Edit Company Profile" and print this one-page document.
- This one-page document must be submitted prior to a contract or purchase order being issued.

If you are **not** currently enrolled in E-Verify, follow these instructions:

- Log onto www.uscis.gov/everify
- Click "Getting Started" for information about the program, requirements, and enrollment process.
- Click "Enroll in E-Verify" and begin enrollment process.
- When enrollment process is complete, click "Edit Company Profile" and print this one-page document.
- This one-page document must be submitted prior to a contract or purchase order being issued.
- For further assistance please consult the E-Verify Quick Reference Guide

2.0 QUALIFICATIONS AND STANDARDS

Due to the importance of maintaining a safe University environment, it is imperative that the successful bidder meet certain qualifications that will guarantee The University of Alabama the successful Bidder is qualified to furnish and deliver products, equipment and services or furnish, deliver, install, service and/or repair equipment whichever is applicable as required in this Solicitation. In order for Bidders to qualify, the following requirements must be fulfilled:

2.1 The Bidder, if requested, must provide in writing, a statement that the Bidder has been regularly engaged in business for a minimum three (3) years engaging in furnishing, delivering, servicing, repairing and installing, equipment, goods, or services required in this Solicitation. In lieu of the minimum number of years in business, a performance bond may be required in the amount of one hundred (100%) percent of the contract price. This bond will be used to secure the completion of the project should the successful Bidder default for any reason. Failure to comply with this requirement may eliminate your bid response from consideration.

2.2 Each bidder required to provide a bond, shall submit a letter from a bonding agent licensed to do business in the State of Alabama stating that if the bidding company is the successful bidder, said bonding agent will furnish a 100% performance and payment bond covering and including products and service for the duration of the contract period. Said bond shall be subject to the approval and acceptance of The University of Alabama. The Letter and Bond shall be submitted to the University Purchasing Department and must be furnished within forty-eight (48) hours after request. The premium of the bond shall be paid by the successful bidder. Failure to provide the bond letter or bond will eliminate your bid from consideration in the bid award.

3.0 REFERENCES

References must include at least three (3) other universities, institutions or businesses, which the bidder has successfully provided products, services or installation of equipment similar to those required in this Solicitation in terms of manufacturer, size, features, service or type of installation. The references must include company name, address, project/delivery date, contact name, phone number, and email address.

4.0 PRODUCT SPECIFICATIONS

Specify all terms and conditions of the warranties associated with your products with your bid response.

5.0 PRICE QUOTATION

5.1 IMPORTANT: It is required that the PRICE QUOTATION SHEET(S) furnished with this Request for Price Quotation be completed and submitted with your proposal. DO NOT send generated price lists as your bid. Failure to comply with this request may eliminate your bid from consideration in the bid award.

5.2 All prices shall be quoted furnish and install (if applicable) FOB The University of Alabama, Tuscaloosa, AL 35487 prepay and allowed. Unit prices quoted must include any and all shipping and handling charges. Any freight claims will be the responsibility of the Bidder. The successful Bidder must transport at the time of set-up, the equipment and supplies necessary for this installation to campus. No direct shipments will be accepted.

5.3 It is the Bidder's responsibility to verify any information, measurements and obtain any clarifications prior to submitting the bid response. The University is not liable for any errors or misinterpretations made by the Bidder in response to this Solicitation.

5.4 The successful Bidder under the specifications required in this Solicitation shall furnish at its expense all equipment, labor, tools, supplies, transportation, insurance and other expenses necessary to fully perform any phase of the requirements of this Solicitation.

5.5 Quote prices firm for a period of ninety (90) days following the bid opening date unless otherwise stated in the Special Conditions. Bids that do not guarantee pricing firm for this period may be eliminated. Failure to quote the term for which your prices will remain firm may eliminate your bid from consideration.

5.6 The quoted price must include but not be limited to all cables, wires, connectors, etc. to make a complete functioning unit unless specifically stated in the special conditions.

5.7 Include with your bid response complete details of your company's Return Merchandise policy, including, but not limited to, amount of any restocking fee required, procedures, limitations, contact person and phone number. While the University does not enter into any purchase with the intent to return items ordered, we do require this information be included with your bid response. Failure to include this information may be grounds for elimination of your bid from consideration.

6.0 DELIVERY, INSTALLATION AND TRAINING REQUIREMENTS

6.1 Proposed delivery dates shall be stated in number of calendar days after receipt of order.

6.2 All items must be delivered directly to the University by the successful Bidder and placed according to the instructions supplied by the University.

7.0 INSURANCE

7.1 See General Terms and Conditions for general Insurance Requirements, Additional Insurance requirements may be listed in the Special Conditions Section.

7.2 The successful Bidder shall provide the University Purchasing Department a certificate of insurance listing the required types of insurance and minimum liabilities specified in the General Terms and Conditions unless otherwise modified in the Special Conditions.

7.3 The certificate must be received by The University of Alabama Purchasing Department within three (3) days of request. Failure to comply with this request may eliminate your bid from consideration in the bid award.

7.4 The University reserves the right to terminate any resulting contract, if the Bidder fails to keep these policies in force for the above amounts or for the duration of the contract period.

7.5 The umbrella policy must be listed on the insurance certificate with an explanation of the coverage.

8.0 RESTRICTIONS ON COMMUNICATIONS WITH UNIVERSITY STAFF

From the issue date of this Solicitation until a Contractor is selected and a contract award is made, Bidders are not allowed to communicate about the subject of the IFB with any University administrator faculty, staff, or members of the Board of Trustees except:

- The Purchasing Department representative, any University Purchasing Official representing the University administration, or others authorized in writing by the Purchasing Office and
- University Representatives during Bidder presentations.

If violation of this provision occurs, the University reserves the right to reject the Bidder's response to this Solicitation.

9.0 SPECIAL CONDITIONS

9.1 The University of Alabama is requesting sealed bids to **Furnish, Deliver, Set-In-Place, Install and Start up a Spark-ignited Generator Set and Automatic Transfer Switch for Capstone Village.** All proposed equipment must meet attached technical specifications or equal.

9.2 **Warranty**:
The generator set, automatic transfer switch and associated equipment shall be warranted for a minimum period of 2 years from the date of commissioning against defects in materials and workmanship. Reference section 16231, Part 3 – Execution, 3.6 and section 16415, Part 3 – Execution, 3.3 for more details.

9.3 **Codes and Standards**:
For the Generator Set reference section 16231 Part 1 – General, 1.2A through 1.2E.
For the Automatic Transfer Switch reference section 16415, Part 1 – General, 1.2A through 1.2C.

9.4 **Dimension Requirements:**
The generator set (including enclosure) and the automatic transfer switch shall not exceed the dimensions of the specified Cummins Equipment (view attachment for details).

9.5 **Testing:**
The generator set supplier should perform a complete operational test on the generator set and automatic transfer switch *prior* to shipping from the factory. A certified test report must be provided. Reference section 16231, Part 3 – Execution, 3.2A-3.2C and section 16415, Part 3 – Execution, 3.1A for more details.

A complete acceptance test in accordance with NFPA 110 is required following installation of the generator set. Reference section 16231, Part 3 – Execution, 3.3 for more details.

9.6 **Training:**
The generator set equipment supplier must provide training for the facility operating personnel covering operation and maintenance of the equipment provided.

After generator set installation the supplier must also provide a service seminar to offer instruction on operation of the transfer equipment, normal testing and exercise, adjustments to the control system, use of the PC based service maintenance tools and emergency operation procedures.

All training shall be not less than four (4) hours in duration and the class size shall be limited to not less than five (5) persons. Reference section 16231, Part 3 –Execution, 3.4 and section 16415, Part 3 – Execution, 3.2D for more details.

Training details should be coordinated with The University of Alabama Project Manager, Matt Denaburg (205) 348-1945.

9.7 **Service:**
All equipment must be serviced by a local service organization that is trained and factory certified in generator set services. The service organization shall be on call 24 hours per day, 365 days per year and should be located no more than 75 miles from the project site. Reference section16231, Part 3 – Execution, 3.5 and section 16415, Part 3 –Execution, 3.2 for more details.

9.8 **Insurance:**
The awarded vendor will be required to provide a copy of their insurance certificate before a purchase order will be issued.

The Board of Trustees of The University of Alabama, its individual trustees, officers, directors, employees, agents and representatives must be included as an additional insured as respect to the Commercial General Liability & Excess/Umbrella policy. Unless precluded by law, all policies waive the right to recovery or subrogation against the Board of Trustees of The University of Alabama, its individual trustees, officers, directors, employees, agents and representatives. Coverage is to be primary and non-contributory with other coverage, if any, purchased by the University

The insurance policies shall be issued by an insurance company licensed to do business in the State of Alabama carrying an AM Best's rating of A- VII or better, and the certificate must be signed by an authorized agent.

See Section 7.0 of the Invitation for Bid.

9.9 **Mandatory On-Site:**
The University of Alabama requires all prospective bidders to attend an on-site visit scheduled for **Tuesday, April 1, at 10:00am.** All bidders should meet outside the main entrance of Capstone Village (address below) and sign in before viewing the site. Failure to attend the scheduled on-site may eliminate your bid from consideration.

Capstone Village
601 5th Ave E.
Tuscaloosa, AL 35401

10.0 QUOTE SHEET

The University of Alabama is requesting sealed bids to Furnish, Deliver, Set-In-Place, Install and Start up a Spark-ignited Generator Set and Automatic Transfer Switch for Capstone Village as per attached specifications, or equal.

1) ALL INFORMATION REQUESTED BELOW MUST BE COMPLETED FOR YOUR BID TO BE CONSIDERED IN THE BID AWARD.

2. UNIT COST FOR EACH ITEM MUST INCLUDE ANY ASSOCIATED SHIPPING CHARGES. DO NOT LIST SEPARATELY. FAILURE TO COMPLY WITH THIS REQUIREMENT MAY ELIMINATE YOUR BID FROM CONSIDERATION.

3) THE UNIVERSITY WILL NOT ACCEPT AN OVERAGE OR UNDERAGE FROM THE QUANTITIES SPECIFIED ON THE PURCHASE ORDER

QUOTE THE FOLLOWING OR EQUAL:

ITEM NO.	QTY.	DESCRIPTION	TOTAL COST
1.	1 EA	**Spark-ignited Generator Set; 125kW standby EPA emissions Per Bid Specifications or Equal. (includes installation)** **MANUFACTURER:** _____ **MODEL:** _____	$_____
2.	1 EA	**Automatic Transfer Switch Per Bid Specifications or Equal. (includes installation)** **MANUFACTURER:** _____ **MODEL:** _____	$_____

Warranty: _____

_____

_____

_____

_____

SECTION 16231 – GENERATOR SETS

PART 1 - GENERAL

1.1 SCOPE

A. Provide complete factory assembled generator set equipment with digital (microprocessor-based) electronic generator set controls, digital governor, and digital voltage regulator.

B. Provide factory test, startup by a supplier authorized by the equipment manufacturer(s), and on-site testing of the system.

C. The generator set manufacturer shall warrant all equipment provided under this section, whether or not is manufactured by the generator set manufacturer, so that there is one source for warranty and product service. Technicians specifically trained and certified by the manufacturer to support the product and employed by the generator set supplier shall service the generator sets.

1.2 CODES AND STANDARDS

A. The generator set installation and on-site testing shall conform to the requirements of the following codes and standards, as applicable. The generator set shall include necessary features to meet the requirements of the latest editions of the following standards/codes where applicable:

1. CSA 282, 1989 Emergency Electrical Power Supply for Buildings

2. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications

3. International Building Codes.

4. NFPA70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.

5. NFPA99 – Essential Electrical Systems for Health Care Facilities.

6. NFPA110 – Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.

B. The generator set and supplied accessories shall meet the requirements of the latest editions of the following standards where applicable:

1. NEMA MG1-1998 part 32. Alternator shall comply with the requirements of this standard.

2. UL142 – Sub-base Tanks

3. UL1236 – Battery Chargers

4. UL2200. The generator set shall be UL2200 listed and labeled by Underwriters Laboratories (UL).

C. The generator set and supplied accessories shall meet all applicable Environmental Protection Agency (EPA) TIER Emission Level or Emission Certification requirements in effect at the time the generator set is ordered.

D. The control system for the generator set shall comply with the following requirements.

1. CSA C22.2, No. 14 – M91 Industrial Control Equipment.

2. EN50082-2, Electromagnetic Compatibility – Generic Immunity Requirements, Part 2: Industrial.

3. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.

4. FCC Part 15, Subpart B.

5. IEC8528 part 4. Control Systems for Generator Sets

6. IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.

7. UL508. The entire control system of the generator set shall be UL508 listed and labeled.

8. UL1236 –Battery Chargers.

E. The generator set manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.3 ACCEPTABLE MANUFACTURERS

A. Cummins or equal.

PART 2 - PRODUCTS

2.1 GENERATOR SET

A. Ratings

1. The generator set assembly (including both the motor/engine assembly and the generator assembly) shall operate at 1800 rpm, and the generator shall produce a 60 Hz waveform.

2. Voltage and phase ratings shall be 208 volt, 3-Phase.

3. Minimum kW rating (and associated alternator sizing) shall be the greater of the following:

4. 125 KW Minimum.

5. Ratings required to provide skVA as follows (shall be documented with reports in submittals using generator sizing software described in Part 3 below):

6. The generator shall be sized to support the loads listed below in a single step arrangement with a maximum allowable voltage dip of 15% and a maximum allowable frequency dip of 10%:

    a. Fire Alarm - 1.0 KVA
    b. Data Rooms (UPS) - 12 KVA
    c. Elevator Cab Lighting & Controls - 1.0 KVA
    d. Data Rooms Ductless Split Systems - 4 Tons
    e. Elevator - 20HP - 72 RLA / 166 amps at start-up

7. kVA rating shall be 1.25 times the kW rating (based on .8 PF).

8. Unless shown otherwise on plans, the generator set shall be rated based on the following site conditions:
    a. Altitude of project site.
    b. Ambient temperatures up to 120 degrees F.

9. The generator set rating shall be based on emergency/standby service unless noted otherwise.

10. The generator set shall be 12-lead reconnectable.

B. Performance

1. Voltage regulation shall be plus or minus 0.5 percent for any constant load between no load and rated load. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.

2. Frequency regulation shall be isochronous from steady state no load to steady state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.5%.

3. The engine-generator set shall be capable of accepting a single step load of 100% nameplate kW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.

4. Minimum motor starting capability shall be as shown on plans. The generator set shall be capable of recovering to a minimum of 90% of rated no load voltage following the application of the specified skVA load at near zero power factor applied to the generator set. Maximum voltage dip on application of this load, considering both alternator performance and engine speed changes shall not exceed 20% unless shown otherwise on plans.

5. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic, and no 3rd order harmonics or their multiples. Telephone influence factor shall be less than 40.

6. The generator set shall be certified by the engine manufacturer to be suitable for use at the installed location and rating, and shall meet all applicable exhaust emission requirements at the time of commissioning.

C. Construction

1. The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.

2. The engine-generator set shall be rated for the seismic conditions for the installation location as mapped by the US Geological Survey and required by local building codes.

3. All switches, lamps, and meters in the control system shall be oil-tight and dust-tight. All active control components shall be installed within a UL/NEMA 3R enclosure. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts.

D. Connections

1. The generator set load connections shall be composed of silver or tin plated copper bus bars, drilled to accept compression terminations of the number and size as shown on the drawings. Sufficient lug space shall be provided for use with cables of the number and size as shown on the drawings.

2. Power connections to auxiliary devices shall be made at the devices, with required overcurrent protection located at panelboard(s) external to the generator set.

3. Generator set control interfaces to other system components shall be made on a permanently labeled terminal block assembly. Labels describing connection point functions shall be provided.

2.2 ENGINE AND ENGINE EQUIPMENT

A. The engine shall be natural gas fueled, radiator and fan cooled. The horsepower rating of the engine at its minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Two cycle engines are not acceptable. Engine accessories and features shall include:

1. Complete engine fuel system, including all pressure regulators, strainers, and control valves. The fuel system shall be plumbed to the generator set skid for ease of site connections to the generator set.

2. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed and operating in various isochronous or parallel states. The governing system shall include a programmable warm up at idle and cooldown at idle function. While operating in idle state, the control system shall disable the alternator excitation system.

3. Skid-mounted radiator and cooling system rated for full load operation in 120 degrees F ambient as measured at the generator air inlet. Radiator fan shall be suitable for use in a system with 0.5 in H_2O restriction. Radiator shall be sized based on a core temperature that is 20F higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The equipment manufacturer shall fill the cooling system with a 50/50-ethylene glycol/water mixture prior to shipping. Rotating parts shall be guarded against accidental contact.

4. Electric starter(s) capable of three complete cranking cycles without overheating.

5. Positive displacement, mechanical, full pressure, lubrication oil pump.

6. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.

7. Replaceable dry element air cleaner with restriction indicator.

8. Flexible fuel lines.

9. Engine mounted battery charging alternator and solid-state voltage regulator.

10. Block heater
    a. Engine mounted, thermostatically controlled, block heater(s) for each engine. Heater voltage shall be as shown on the project drawings. The coolant heater shall be UL499 listed and labeled.
    b. The block heater shall be installed on the engine with silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The block heater installation shall be specifically designed to provide proper venting of the system. The block heaters shall be installed using quick disconnect couplers to isolate the heaters for replacement of the heater element without draining the coolant from the generator set. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.
    c. The block heater shall be provided with a DC thermostat, installed at the engine thermostat housing. An AC power connection box shall be provided for a single AC power connection to the block heater system.
    d. The block heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 104F (40C) in a 40F (4C) ambient, in compliance with NFPA110 requirements, or the temperature required for starting and load pickup requirements of this specification. If the heater quantities or wattage ratings are different than shown on plans, contractor shall be responsible for providing the properly-rated circuits (with circuit breakers) as required to the heater(s).

11. Provide vibration isolators, spring & pad type, quantity as recommended by the generator set manufacturer. Isolators shall include seismic restraints if required by site location.

12 Starting and Control Batteries shall be calcium/lead antimony type, 24 volt DC, sized as recommended by the engine manufacturer, complete with battery cables and connectors. The batteries shall be capable of a minimum of three complete 15-second cranking cycles at 40F ambient temperature when fully charged.

13. Provide critical-grade exhaust silencer(s) for each engine of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer. Exhaust system shall be installed according to the engine manufacturer's recommendations and applicable codes and standards.

14. A UL listed/CSA certified voltage regulated battery charger shall be provided for each engine-generator set. The charger shall be located at the generator unless shown otherwise on plans. Output amperage, Input AC voltage and DC output voltage shall be as required. Chargers shall be equipped with float, taper and equalize charge settings. Charger shall include an Analog DC voltmeter and ammeter, 12 hour equalize charge timer, and AC and DC fuses. Operational monitors shall provide visual output along with individual form C contacts rated at 4 amps, 120 VAC, 30VDC for remote indication of:
    a. Loss of AC power - red light
    b. Low battery voltage - red light
    c. High battery voltage - red light
    d. Power ON - green light and N.O. relay contact

2.3 AC GENERATOR

A. The AC generator shall be; synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single pre-lubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system and shall be UL1446 listed. Actual temperature rise measured by resistance method at full load shall not exceed 105 degrees Centigrade.

B. The generator shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.

C. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three phase fault at approximately 300% of rated current for not more than 10 seconds.

D. The subtransient reactance of the alternator shall not exceed 12 percent, based on the standby rating of the generator set.

2.4 GENERATOR SET CONTROL

A. The generator set shall be provided with a microprocessor-based control system that is designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification.

B. The control shall be mounted on the generator set, or may be mounted in a free-standing panel next to the generator set if adequate space and accessibility is available. The control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered.

C. The generator set mounted control shall include the following features and functions:
    1. Control Switches
        a. Mode Select Switch. The mode select switch shall initiate the following control modes. When in the RUN or MANUAL position the generator set shall start, and

accelerate to rated speed and voltage as directed by the operator. A separate push-button to initiate starting is acceptable. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.

b. EMERGENCY STOP switch. Switch shall be Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.

c. RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.

d. PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

2. Generator Set AC Output Metering. The generator set shall be provided with a metering set including the following features and functions:
   a. Digital metering set, 1% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three-phase voltages (line to neutral or line to line) simultaneously.
   b. The control system shall monitor the total load on the generator set, and maintain data logs of total operating hours at specific load levels ranging from 0 to 110% of rated load, in 10% increments. The control shall display hours of operation at less than 30% load and total hours of operation at more than 90% of rated load.
   c. The control system shall log total number of operating hours, total kWH, and total control on hours, as well as total values since reset.
3. Generator Set Alarm and Status Display.
   a. The generator set control shall include LED alarm and status indication lamps. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright exterior day lighting conditions.
   b. The generator set control shall indicate the existence of the warning and shutdown conditions on the control panel. All conditions indicated below for warning shall be field-configurable for shutdown. Conditions required to be annunciated shall include:
      i. low oil pressure (warning)
      ii. low oil pressure (shutdown)
      iii. oil pressure sender failure (warning)
      iv. low coolant temperature (warning)
      v. high coolant temperature (warning)
      vi. high coolant temperature (shutdown)
      vii. high oil temperature (warning)
      viii. engine temperature sender failure (warning)
      ix. low coolant level (warning or shutdown - selectable)
      x. fail to crank (shutdown)
      xi. fail to start/overcrank (shutdown)
      xii. overspeed (shutdown)
      xiii. low DC voltage (warning)
      xiv. high DC voltage (warning)
      xv. weak battery (warning)
      xvi. high AC voltage (shutdown)
      xvii. low AC voltage (shutdown)
      xviii. under frequency (shutdown)
      xix. over current (warning)
      xx. over current (shutdown)

xxi. short circuit (shutdown)
xxii. ground fault (warning) (if genset breaker is rated 1000A or greater)
xxiii. over load (warning)
xxiv. emergency stop (shutdown)
xxv. Provisions shall be made for indication of four (4) customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above-specified conditions.

4. Engine Status Monitoring.
   a. The following information shall be available from a digital status panel on the generator set control :
      i. engine oil pressure (psi or kPA)
      ii. engine coolant temperature (degrees F or C)
      iii. battery voltage (DC volts)
      iv. engine oil temperature (degrees F or C)
      v. engine speed (rpm)
      vi. number of hours of operation (hours)
      vii. number of start attempts
   b. The control system shall also incorporate a data logging and display provision to allow logging of the last 10 warning or shutdown indications on the generator set, as well as total time of operation at various loads, as a percent of the standby rating of the generator set.
5. Engine Control Functions.
   a. The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15 second rest period between cranking periods.
   b. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.
   c. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting.
   d. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.
   e. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature which is capable of discriminating between failed sender or wiring components, and an actual failure conditions.
6. Alternator Control Functions:
   a. The generator set shall include an automatic digital voltage regulation system that is matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, with local indication of setting level.

b. Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (over current shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.

c. Controls shall be provided to individually monitor all three phases of the output current for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator (short circuit shutdown). The protective functions provided shall be in compliance to the requirements of NFPA70 article 445.

d. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition (over load) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.

e. An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

f. When required by National Electrical Code or indicated on project drawings, the control System shall include a ground fault monitoring relay. The relay shall be adjustable from 3.8-1200 amps, and include adjustable time delay of 0-10.0 seconds. The relay shall be for indication only, and not trip or shut down the generator set. Note bonding and grounding requirements for the generator set, and provide relay that will function correctly in system as installed.

7. Other Control Functions

a. The generator set shall communicate with the Automatic Transfer Switch via hardwired control connections as required.

b. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is out of acceptable limits. During engine cranking (starter engaged), the low voltage limit shall be disabled, and DC voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

2.5 GENERATOR REMOTE ANNUNCIATOR

A. Furnish a 20-light LED type remote alarm annunciator with horn. The remote annunciator shall provide all the audible and visual alarms called for by NFPA Standard 110 for level 1 systems for the local generator control panel. Spare lamps shall be provided to allow future addition of other alarm and status functions to the annunciator. Provisions for labeling of the annunciator in a fashion consistent with the specified functions shall be provided. Alarm silence and lamp test switch(es) shall be provided. LED lamps shall be replaceable, and indicating lamp color shall be capable of changes needed for specific application requirements. Alarm horn shall be switchable for all annunciation points. Alarm horn (when switched on) shall sound for first fault, and all subsequent faults, regardless of whether first fault has been cleared, in compliance with NFPA110 3-5.6.2.

B. The interconnecting wiring between the annunciator and other system components shall be monitored and failure of the interconnection between components shall be displayed on the

annunciator panel. Transient Voltage Surge Suppression shall be provided on both ends of any interconnecting wiring (between the annunciator and other system components) that extends outside of a building.

C. The annunciator shall include the following alarm labels, audible annunciation features, and lamp colors:

Condition	Lamp Color	Audible Alarm
Normal Power (to Loads)	Green	No
Genset Supplying Load	Amber	No
Genset Running	Green	No
Not in Auto	Red (Flashing)	Yes
High Battery Voltage	Red	Yes
Low Battery Voltage	Red	Yes
Charger AC Failure	Red	Yes
Fail to Start	Red	Yes
Low Engine Temperature	Amber	Yes
Pre-High Engine Temperature	Amber	Yes
High Engine Temperature	Red	Yes
Pre-Low Oil Pressure	Amber	Yes
Low Oil Pressure	Red	Yes
Overspeed	Red	Yes
Low Coolant Level	Amber	Yes
Low Fuel Level	Amber	Yes
Network OK	Green	Yes
(4) Spares	Configurable	Configurable

2.6 GENERATOR MAIN LINE CIRCUIT BREAKER(S)

A. The generator set shall be provided with unit mounted 400 amp, 3-pole main line circuit breaker. The circuit breaker shall incorporate an electronic trip unit that operates to protect the alternator under all overcurrent conditions, or a thermal-magnetic trip with other overcurrent protection devices that positively protect the alternator under overcurrent conditions. The supplier shall submit time overcurrent characteristic curves and thermal damage curve for the alternator, demonstrating the effectiveness of the protection provided.

2.7 OUTDOOR WEATHER-PROTECTIVE ENCLOSURE

A. The generator set shall be provided with an F173 weatherproof, level 2 sound-attenuated, outdoor enclosure, with the entire package listed under UL2200. The package shall comply with the requirements of the National Electrical Code for all wiring materials and component spacing. The total assembly of generator set and enclosure shall be designed to be lifted into place using spreader bars. Housing shall provide ample airflow for generator set operation at rated load in an ambient temperature of 100F. The housing shall have hinged access doors as required to maintain easy access for all operating and service functions. All doors shall be lockable, and include retainers to hold the door open during service. Enclosure roof shall be cambered to prevent rainwater accumulation. Openings shall be screened to limit access of rodents into the enclosure. All electrical power and control interconnections shall be made within the perimeter of the enclosure.

B. The enclosure shall reduce the sound level of the generator set while operating at full rated load to a maximum of 71 dBA (including exhaust noise) at any location 7 meters from the generator set in a free field environment:

C. The enclosure shall include vertical air discharge hoods as required to redirect discharge air upwards and reduce noise accordingly.

D. The enclosure shall be insulated with non-hydroscopic materials.

E. The enclosure shall be rated for the wind and seismic conditions for the installation location as mapped by the US Geological Survey and required by local building codes.

F. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturers standard color using a two step electrocoating paint process, or equal meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating that meets the following requirements:
1. Primer thickness, 0.5-2.0 mils. Top coat thickness, 0.8-1.2 mils.
2. Gloss, per ASTM D523-89, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.
3. Crosshatch adhesion, per ASTM D3359-93, 4B-5B.
4. Impact resistance, per ASTM D2794-93, 120-160 inch-pounds.
5. Salt Spray, per ASTM B117-90, 1000+ hours.
6. Humidity, per ASTM D2247-92, 1000+ hours.
7. Water Soak, per ASTM D2247-92, 1000+ hours.

G. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant, and designed to minimize marring of the painted surface when removed for normal installation or service work.

H. Enclosure shall be constructed of minimum 12 gauge steel for framework and 14 gauge steel for panels. All hardware and hinges shall be stainless steel.

I. A factory-mounted critical exhaust silencer shall be installed inside the enclosure. The exhaust shall exit the enclosure through a rain collar and terminate with a rain cap. Exhaust connections to the generator set shall be through seamless flexible connections.

J. The enclosure shall include the following maintenance provisions:
1. Flexible coolant and lubricating oil drain lines, that extend to the exterior of the enclosure, with internal drain valves
2. External radiator fill provision.

2.8 SEQUENCE OF OPERATION

A. The maximum elapsed time allowed from loss of normal power to restoration of power to emergency circuits from generator through transfer switch shall be 10 seconds.

B. Generator set shall start upon receipt of a start signal from remote equipment. The start signal shall be via hardwired connection to the generator set control.

C. The generator set shall complete a time delay start period as programmed into the control.

D. The generator set control shall initiate the starting sequence for the generator set. The starting sequence shall include the following functions:
1. The control system shall verify that the engine is rotating when the starter is signaled to operate. If the engine does not rotate after two attempts, the control system shall shut down and lock out the generator set, and indicate “fail to crank” shutdown.

2. The engine shall fire and accelerate as quickly as practical to start disconnect speed. If the engine does not start, it shall complete a cycle cranking process as described elsewhere in this specification. If the engine has not started by the completion of the cycle cranking sequence, it shall be shut down and locked out, and the control system shall indicate “fail to start”.
3. The engine shall accelerate to rated speed and the alternator to rated voltage. Excitation shall be disabled until the engine has exceeded programmed idle speed, and regulated to prevent over voltage conditions and oscillation as the engine accelerates and the alternator builds to rated voltage.
4. On reaching rated speed and voltage, the generator set shall operate as dictated by the control system in isochronous, synchronize, load share, load demand or load govern state.

E. When all start signals have been removed from the generator set, it shall complete a time delay stop sequence. The duration of the time delay stop period shall be adjustable by the operator.

F. On completion of the time delay stop period, the generator set control shall switch off the excitation system and shall shut down.

G. Any start signal received after the time stop sequence has begun shall immediately terminate the stopping sequence and return the generator set to isochronous operation.

PART 3 - EXECUTION

3.1 SUBMITTALS

A. Equipment supplier shall provide six sets of the following information for review:
1. Manufacturer’s product literature and performance data, sufficient to verify compliance to specification requirements. Manufacturer shall include computer generated sizing report.
2. A paragraph by paragraph specification compliance statement, describing the differences between the specified and the proposed equipment.
3. Manufacturer's certification of prototype testing.
4. Manufacturer's published warranty documents.
5. Shop drawings showing plan and elevation views with certified overall dimensions, as well as wiring interconnection details.
6. Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.
7. Manufacturer's installation instructions.

3.2 FACTORY TESTING

A. The generator set supplier shall perform a complete operational test on the generator set prior to shipping from the factory. A certified test report shall be provided. Equipment supplied shall be fully tested at the factory for function and performance.

B. Factory testing may be witnessed by the owner and consulting engineer. Costs for travel expenses will be the responsibility of the owner and consulting engineer. Supplier is responsible to provide two weeks notice for testing.

C. Generator set factory tests on the equipment shall be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be

acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and function of safety shutdowns.

3.3 ON-SITE ACCEPTANCE TEST:

A. The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by owner. The Engineer shall be notified in advance and shall have the option to witness the tests.

B. Installation acceptance tests to be conducted on-site shall include the following (performed in accordance with NFPA 110):
   1. "Cold start" test.
   2. Four (4) hour full load test. Provide resistive load banks and make temporary connections as required.
   3. One step rated load pickup test.
   4. Power failure test on the entire installed system. This test shall be conducted by opening the power supply from the utility service, and observing proper operation of the system for at least 2 hours. Coordinate timing and obtain approval for start of test with site personnel.

3.4 TRAINING

A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to not less than 5 persons. Training date shall be coordinated with the facility owner.

3.5 SERVICE AND SUPPORT

A. The manufacturer of the generator set shall maintain service parts inventory at a central location which is accessible to the service location 24 hours per day, 365 days per year.

B. The generator set shall be distributed and serviced by a local service organization that is trained and factory certified in generator set service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year and shall be located no more than 75 miles from the project site.

C. The manufacturer of the generator set shall own, maintain and make available (to engineer, free of charge) generator set sizing software that calculates voltage dip, frequency dip, THID and THVD of proposed generator/alternator set using the following inputs:

D. Summary of step loads including load type (across-the-line motor, VFD, Fire Pump, Fluorescent Lighting, UPS, etc.).

E. Generator Set Duty (Standby, Prime, Continuous).

F. Maximum Ambient Temperature.

G. Project site altitude.

H. Generator Fuel type.

I. Voltage/Phase/Frequency.

J. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.

3.6 Warranty

A. The generator set and associated equipment shall be warranted for a period of not less than 2 years from the date of commissioning against defects in materials and workmanship.

B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

END OF SECTION 16231

Specification sheet

Spark-ignited generator set

125 kW standby
EPA emissions

Description

Cummins Power Generation commercial generator sets are fully integrated power generation systems providing optimum performance, reliability and versatility for stationary standby and prime power applications.

Features

Ford heavy-duty gas engine - Rugged 4-cycle industrial spark-ignited delivers reliable power. The electronic air/fuel ratio control provides optimum engine performance and fast response to load changes.

Three-Way Catalyst - Simultaneously converts NO_x, CO and HC to nitrogen, oxygen, carbon dioxide and water, minimizing the harmful emissions of the generator set.

Alternator - Several alternator sizes offer selectable motor starting capability with low reactance 2/3 pitch windings, low waveform distortion with non-linear loads and fault clearing short-circuit capability.

Control system - The PowerCommand® electronic control is standard equipment and provides total genset system integration including automatic remote starting/stopping, precise frequency and voltage regulation, alarm and status message display, AmpSentry™ protection, output metering, auto-shutdown at fault detection and NFPA 110 Level 1 compliance.

Cooling system - Standard cooling package provides reliable running at up to 40 °C (104 °F) ambient temperature.

Enclosures - Optional weather protective and sound attenuated enclosures are available.

NFPA - The generator set complies with NFPA 110 for Level 1 - Type 10 systems.

Warranty and service - Backed by a comprehensive warranty and worldwide distributor network.

	Natural Gas				Propane				
	Standby rating		Prime rating		Standby rating		Prime rating		Data sheets
Model	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz kW (kVA)	50 Hz kW (kVA)	60 Hz
GGHJ	125 (156)				125 (156)				NAD-5530-EN

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Generator set specifications

Governor regulation class	ISO 8528 Part 1 Class G3
Voltage regulation, no load to full load	± 1.0%
Random voltage variation	± 1.0%
Frequency regulation	Isochronous
Random frequency variation	GGHJ ± 0.5%
Radio frequency emissions compliance	Meets requirements of most industrial and commercial applications

Engine specifications

Design	Turbocharged
Bore	90.2 mm (3.55 in)
Stroke	105.9 mm (4.17 in)
Displacement	6.8 L (412.5 in^3)
Cylinder block	Cast iron, V 10 cylinder
Battery capacity	600 amps minimum at ambient temperature of 0 °C (32 °F)
Battery charging alternator	95 amps
Starting voltage	12 volt, negative ground
Lube oil filter type(s)	Single spin-on canister-combination full flow with bypass
Standard cooling system	40 °C (104 °F) ambient radiator

Alternator specifications

Design	Brushless, 4 pole, drip proof, revolving field
Stator	2/3 pitch
Rotor	Direct coupled, flexible disc
Insulation system	Class H per NEMA MG1-1.65
Standard temperature rise	150 °C (302 °F) standby
Exciter type	Torque match (shunt)
Phase rotation	A (U), B (V), C (W)
Alternator cooling	Direct drive centrifugal blower
AC waveform total harmonic distortion	< 5% no load to full linear load, < 3% for any single harmonic
Telephone influence factor (TIF)	< 50 per NEMA MG1-22.43
Telephone harmonic factor (THF)	< 3

Available voltages

60 Hz

3-phase			1-phase
• 120/208	• 120/240	• 127/220	• 120/240
• 139/240	• 240/416	• 254/440	
• 277/480	• 347/600		

Note: Consult factory for other voltages.

Generator set options and accessories

Engine
- ☐ 120/240 V 1500 W coolant heaters

Fuel system
- ☐ Natural gas
- ☐ Natural gas/propane liquid with automatic changeover
- ☐ Natural gas/propane vapor with automatic changeover
- ☐ Propane liquid withdrawal
- ☐ Vapor withdrawal

Alternator
- ☐ 105 °C (221 °F) rise alternator
- ☐ 125 °C (257 °F) rise alternator
- ☐ 150 °C (302 °F) rise alternator
- ☐ 120/240 V, 100 W anti-condensation heater
- ☐ 12 lead, broad range, extended stack (full single phase output)
- ☐ Lower broad range
- ☐ PMG excitation
- ☐ Upper broad range
- ☐ Single phase (4 lead)

Exhaust system
- ☐ Mounted residential muffler

Generator set
- ☐ AC entrance box
- ☐ Battery
- ☐ Battery charger
- ☐ Duct adapter
- ☐ Enclosure: Aluminum, steel, weather protection or sound attenuated
- ☐ Export box packaging
- ☐ Main line circuit breaker
- ☐ Remote annunciator panel
- ☐ UL 2200 Listed
- ☐ 2 year, 4000 hour and 3 year, 6000 hour prime power warranty
- ☐ 3 year, 5 year and 10 year standby warranty with parts, parts and labor, or parts, labor and travel

Note: Some options may not be available on all models - consult factory for availability.

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Control system PCC 2100

PowerCommand PCC2100 - An integrated generator set control system providing governing, voltage regulation, engine protection and operator interface functions.

- Includes integral AmpSentry protection, which provides a full range of alternator protection functions that are matched to the alternator provided.
- Control function provides battery monitoring and testing features, and smart starting control system.
- Three phase sensing, full wave rectified voltage regulation system, with a PWM output for stable operation with all load types.
- Standard PCCNet interface.
- Suitable for operation in ambient temperatures from -40 °C to +70 °C (-40 °F to +158 °F) and altitudes to 5000 m (13,000 ft).
- Prototype tested; UL, CSA and CE compliant.
- InPower™ PC-based service tool available for detailed diagnostics, setup, data logging and fault simulation.

AmpSentry AC protection

- AmpSentry Protective Relay – UL-listed
- Over current and short-circuit shutdown
- Over current warning
- Single and three phase fault regulation
- Over and under voltage shutdown
- Over and under frequency shutdown
- Overload warning with alarm contact
- Reverse power and reverse Var shutdown
- Field Overload

Engine protection

- Overspeed shutdown
- Low oil pressure warning and shutdown
- High coolant temperature warning and shutdown
- High oil temperature warning (optional)
- Low coolant level warning or shutdown (optional)
- Low coolant temperature warning
- High and low battery voltage warning
- Weak battery warning
- Dead battery shutdown
- Fail to start (overcrank) shutdown
- Fail to crank shutdown
- Redundant start disconnect
- Cranking lockout
- Sensor failure indication

Operator interface

- Off/manual/auto mode switch
- Manual run/stop switch
- Panel lamp/test switch
- Emergency stop switch
- Alpha-numeric display with pushbutton access, for viewing engine and alternator data and providing setup, controls and adjustments
- LED lamps indicating genset running, not in auto, common warning, common shutdown
- (5) configurable LED lamps
- LED bargraph AC data display (optional)

Alternator data

- Line-to-line and line-to-neutral AC volts
- Three phase AC current
- Frequency
- Total and individual phase kW and kVA

Engine Data

- DC voltage
- Lube oil pressure
- Coolant temperature
- Lube oil temperature (optional)

Other data

- Genset model data
- Start attempts, starts, running hours
- KW hours (total and since reset)
- Fault history
- Load profile (hours less than 30% and hours more than 90% load)
- System data display (optional with network and other PowerCommand gensets or transfer switches)

Governing

- Integrated digital electronic isochronous governor
- Temperature dynamic governing
- Smart idle speed mode (some models)
- Glow plug control (some models)

Voltage regulation

- Integrated digital electronic voltage regulator
- Three phase line-to-neutral sensing
- Configurable torque matching
- PMG (optional)

Control functions

- Data logging on faults
- Fault simulation (requires InPower)
- Time delay start and cooldown
- Cycle cranking
- (3) configurable customer inputs
- (3) configurable customer outputs

Options

- ☐ Analog AC Meter Display
- ☐ Thermostatically Controlled Space Heater
- ☐ Key-type mode switch
- ☐ Ground fault module
- ☐ Auxiliary relays (3)
- ☐ Echelon LONWORKS interface
- ☐ Modlon Gateway to convert to Modbus (loose)
- ☐ PowerCommand iWatch web server for remote monitoring and alarm notification (loose)
- ☐ PCCNet and Lonworks Digital input and output module(s) and Remote annunciators (loose)

PowerCommand 2100 control operator/display panel

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Emergency standby power (ESP):

Applicable for supplying power to varying electrical load for the duration of power interruption of a reliable utility source. Emergency Standby Power (ESP) is in accordance with ISO 8528. Fuel Stop power in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Limited-time running power (LTP):

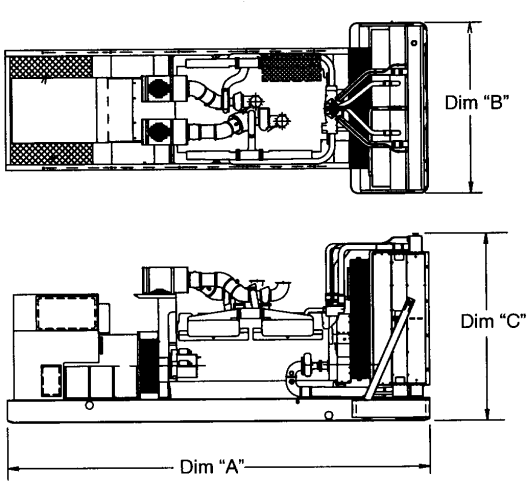
Applicable for supplying power to a constant electrical load for limited hours. Limited Time Running Power (LTP) is in accordance with ISO 8528.

Prime power (PRP):

Applicable for supplying power to varying electrical load for unlimited hours. Prime Power (PRP) is in accordance with ISO 8528. Ten percent overload capability is available in accordance with ISO 3046, AS 2789, DIN 6271 and BS 5514.

Base load (continuous) power (COP):

Applicable for supplying power continuously to a constant electrical load for unlimited hours. Continuous Power (COP) in accordance with ISO 8528, ISO 3046, AS 2789, DIN 6271 and BS 5514.



This outline drawing is for reference only. See respective model data sheet for specific model outline drawing number.

Do not use for installation design

Model	Dim "A" mm (in.)	Dim "B" mm (in.)	Dim "C" mm (in.)	Set Weight* dry kg (lbs)	Set Weight* wet kg (lbs)
GGHJ	2662 (104.8)	1016 (40.0)	1397 (55.0)	TBD	1225 (2700)

* Weights represent a set with standard features. See outline drawings for weights of other configurations.

Codes and standards

Codes or standards compliance may not be available with all model configurations – consult factory for availability.

ISO 9001	This generator set is designed in facilities certified to ISO 9001 and manufactured in facilities certified to ISO 9001 or ISO 9002.	UL	The generator set is available Listed to UL 2200, Stationary Engine Generator Assemblies. The PowerCommand control is Listed to UL 508 - Category NITW7 for U.S. and Canadian usage.
PTS	The Prototype Test Support (PTS) program verifies the performance integrity of the generator set design. Cummins Power Generation products bearing the PTS symbol meet the prototype test requirements of NFPA 110 for Level 1 systems.	**U.S. EPA**	Engine certified to U.S. EPA SI Stationary Emission Regulation 40 CFR, Part 60.
CSA	All low voltage models are CSA certified to product class 4215-01.	**International Building Code**	The generator set package is available certified for seismic application in accordance with the following International Building Code: IBC2000, IBC2003, IBC2006, IBC2009 and IBC2012.

Warning: Back feed to a utility system can cause electrocution and/or property damage. Do not connect to any building's electrical system except through an approved device or after building main switch is open.

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NAS-5524c-EN (8/13)

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SECTION 16415 – AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SCOPE

A. Provide complete factory assembled power transfer equipment with field programmable digital electronic controls designed for fully automatic operation and including: surge voltage isolation, voltage sensors on all phases of both sources, power switch mechanism, permanently attached manual operation provisions, positive mechanical and electrical interlocking, and mechanically held contacts for both sources.

B. The generator set manufacturer shall supply and shall warrant transfer switches to provide a single source of responsibility for all the products provided. Technicians specifically trained to support the product shall service the transfer switches.

1.2 CODES AND STANDARDS

A. The automatic transfer switch installation and application shall conform to the requirements of the following codes and standards:
1. CSA 282, Emergency Electrical Power Supply for Buildings
2. NFPA70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
3. NFPA99 – Essential Electrical Systems for Health Care Facilities
4. NFPA110 – Emergency and Standby Power Systems. The transfer switch shall meet all requirements for Level 1 systems.
5. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications.
6. NEMA ICS10-1993 – AC Automatic Transfer Switches.

B. The transfer switch assembly shall comply with the following standards:
1. CSA C22.2, No. 14 – M91 Industrial Control Equipment.
2. EN55011, Class B Radiated Emissions
3. EN55011, Class B Conducted Emissions
4. IEC 1000-4-5 (EN 61000-4-5); AC Surge Immunity.
5. IEC 1000-4-4 (EN 61000-4-4) Fast Transients Immunity
6. IEC 1000-4-2 (EN 61000-4-2) Electrostatic Discharge Immunity
7. IEC 1000-4-3 (EN 61000-4-3) Radiated Field Immunity
8. IEC 1000-4-6 Conducted Field Immunity
9. IEC 1000-4-11 Voltage Dip Immunity.
10. IEEE 62.41, AC Voltage Surge Immunity.
11. IEEE 62.45, AC Voltage Surge.
12. UL1008 – Transfer Switches. Transfer switches shall be UL1008 listed and labeled. UL1008 transfer switches may be supplied in UL891 enclosures if necessary to meet the physical requirements of the project.

C. The transfer switch manufacturer shall be certified to ISO 9001 International Quality Standard and shall have third party certification verifying quality assurance in design/development, production, installation, and service, in accordance with ISO 9001.

1.3 ACCEPTABLE MANUFACTURERS

A. Cummins or equal.

PART 2 - PRODUCTS

2.1 POWER TRANSFER SWITCH

A. Ratings
1. The automatic transfer switch shall be a 400 amp, 208 volt, 3-pole, 4-wire, solid neutral open transition type switch in NEMA 1 enclosure with 100,000 amp withstand current rating (WCR). Withstand current rating (WCR) may be accomplished by way of an internal fuse block with current limiting fuses. Fuse block and fuses shall be mounted within the transfer switch enclosure.
2. Main contacts shall be rated for 600 Volts AC minimum.
3. Transfer switches shall be rated to carry 100 percent of rated current continuously in the enclosure supplied, in ambient temperatures of -40 to +60 degrees C, relative humidity up to 95% (non-condensing), and altitudes up to 10,000 feet (3000M).
4. Transfer switch equipment shall have withstand and closing ratings (WCR) in RMS symmetrical amperes equal to or greater than the required ratings specified.

B. Construction
1. Transfer switches shall be double-throw, electrically and mechanically interlocked, and mechanically held in the source 1 and source 2 positions. The transfer switch shall be specifically designed to transfer to the best available source if it inadvertently stops in a neutral position.
2. Transfer switches shall be of the Open Transition type. Transfer switches rated through 1000 amperes shall be equipped with permanently attached manual operating handles and quick-break, quick-make over-center contact mechanisms. Transfer switches over 1000 amperes shall be equipped with manual operators for service use only under de-energized conditions.
3. Main switch contacts shall be high-pressure silver alloy. Contact assemblies shall have arc chutes for positive arc extinguishing. Arc chutes shall have insulating covers to prevent inter-phase flashover.
4. All wiring shall be UL listed 105 degree C, 600 volt rated, and sized as required. Each wire, device or function shall be identified with a source and destination by silk-screen or similar permanent identification. Circuit boards shall be connected wiring harnesses by means of locking disconnect plug(s), to allow the control system to be easily disconnected and serviced without disconnecting power from the transfer switch mechanism.
5. Bus structures shall be constructed from silver plated copper or tin plated aluminum with bolted joints for all three phases, with a full neutral, and a 1/4 x 2 inch ground bus extending through all sections.
6. The framework and all other sheet metal components of the system shall be primed with a rust-inhibiting primer, and finished with two coats of satin finish ANSI 61 gray enamel, or manufacturer's standard color.
7. All door mounted control components shall be industrial type oil-tight devices with contact ratings a minimum of twice the maximum circuit ampacity they are controlling. Toggle switches and other light duty and durability control devices are not acceptable. Indicator lamps shall be high intensity LED type devices. Indicator lamp condition (on or off) shall be easily visible in bright room lighting conditions.

8. Power transfer switch shall be provided with flame retardant transparent covers to allow viewing of switch contact operation or shall be indicated by mechanical flags. Barriers shall be provided to prevent inadvertent contact with any voltage of greater than 50VDC.
9. Transfer switches shall be 4-pole with a switched neutral pole. The neutral pole shall be of the same construction and have the same ratings as the phase poles. All poles shall be switched simultaneously using a common crossbar. Equipment using overlapping neutral contacts is not acceptable.

C. Connections
1. Field control connections shall be made on a common terminal block that is clearly and permanently labeled.
2. Transfer switch shall be provided with AL/CU compression lugs suitable for the number and size of conductors shown on the drawings.

2.2 TRANSFER SWITCH CONTROL

A. Operator Panel. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The operator panel shall be permanently labeled for switch and control functions. The operator panel shall be provided with the following features and capabilities.
1. High intensity LED lamps to indicate the source that the load is connected to (source 1 or source 2); and which source(s) are available. Source available LED indicators shall operate from the control microprocessor to indicate the true condition of the sources as sensed by the control.
2. High intensity LED lamps to indicate that the transfer switch is “not in auto” (due to control being disabled or due to bypass switch (when used) enabled or in operation) and “Test/Exercise Active” to indicate that the control system is testing or exercising the generator set.
3. “OVERRIDE” pushbutton to cause the transfer switch to bypass any active time delays for start, transfer, and retransfer and immediately proceed with its next logical operation.
4. “TEST” pushbutton to initiate a preprogrammed test sequence for the generator set and transfer switch. The transfer switch shall be programmable for test with load or test without load.
5. “RESET/LAMP TEST” pushbutton that will clear any faults present in the control, or simultaneously test all lamps on the panel by lighting them.
6. The control system shall continuously log information on the number of hours each source has been connected to the load, the number of times transferred, and the total number of times each source has failed. This information shall be available via an operator display panel.
7. Vacuum fluorescent alphanumeric display panel with push-button navigation switches. The display shall be clearly visible in both bright (sunlight) and no light conditions. It shall be visible over an angle of at least 120 degrees. The Alphanumeric display panel shall be capable of providing the following functions and capabilities:
    a. Display source condition information, including AC voltage for each phase of normal and emergency source, frequency of each source. Voltage for all three phases shall be displayed on a single screen for easy viewing of voltage balance. Line to neutral voltages shall be displayed for 4-wire systems.
    b. Display source status, to indicate source is connected or not connected.
    c. The display panel shall allow the operator to view and make the following adjustments in the control system, after entering an access code:
        i. Set nominal voltage and frequency for the transfer switch.
        ii. Adjust voltage and frequency sensor operation set points.
        iii. Set up time clock functions.
        iv. Set up load sequence functions.

v. Enable or disable control functions in the transfer switch, including program transition.
vi. Set up exercise and load test operation conditions, as well as normal system time delays for transfer time, time delay start, stop, transfer, and retransfer.

d. Display Real time Clock data, including date, and time in hours, minutes, and seconds. The real time clock shall be incorporate provisions for automatic daylight savings time and leap year adjustments. The control shall also log total operating hours for the control system.

e. Display service history for the transfer switch. Display source connected hours, to indicate the total number of hours connected to each source. Display number of times transferred, and total number of times each source has failed.

f. Display fault history on the transfer switch, including condition, and date and time of fault. Faults to include controller checksum error, low controller DC voltage, ATS fail to close on transfer, ATS fail to close on retransfer, battery charger malfunction, network battery voltage low, network communications error.

B. Internal Controls

1. The transfer switch control system shall be configurable in the field for any operating voltage level up to 600VAC. Provide RMS voltage sensing and metering that is accurate to within plus or minus 1% of nominal voltage level. Frequency sensing shall be accurate to within plus or minus 0.2%. Voltage sensing shall be monitored based on the normal voltage at the site. Systems that utilize voltage monitoring based on standard voltage conditions that are not field configurable are not acceptable.
2. Transfer switch voltage sensors shall be close differential type, providing source availability information to the control system based on the following functions:

a. Monitoring all phases of the normal service (source 1) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of normal voltage level).
b. Monitoring all phases of the emergency service (source 2) for under voltage conditions (adjustable for pickup in a range of 85 to 98% of the normal voltage level and dropout in a range of 75 to 98% of pickup voltage level).
c. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for voltage imbalance.
d. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for loss of a single phase.
e. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for phase rotation.
f. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over voltage conditions (adjustable for dropout over a range of 105 to 135% of normal voltage, and pickup at 95-99% of dropout voltage level).
g. Monitoring all phases of the normal service (source 1) and emergency service (source 2) for over or under frequency conditions.

3. The transfer control shall incorporate a series of diagnostic LED lamps.
4. The transfer switch shall be configurable to control the operation time from source to source (program transition operation). The control system shall be capable of enabling or disabling this feature, and adjusting the time period to a specific value. A phase band monitor or similar device is not an acceptable alternate for this feature.
5. The transfer switch shall incorporate adjustable time delays for generator set start (adjustable in a range from 0-15 seconds); transfer (adjustable in a range from 0-120 seconds); retransfer (adjustable in a range from 0-30 minutes); and generator stop (cooldown) (adjustable in a range of 0-30 minutes).
6. The transfer switch shall be configurable to accept a relay contact signal from an external device to prevent transfer to the generator service.

7. The control system shall be designed and prototype tested for operation in ambient temperatures from -40C to +70C. It shall be designed and tested to comply with the requirements of the noted voltage surge and RFI/EMI standards.
8. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs, to provide optimum protection from line voltage surges, RFI and EMI.

C. Control Interface
1. The transfer switch will provide an isolated relay contact for starting of a generator set. The relay shall be normally held open, and close to start the generator set. Output contacts shall be form C, for compatibility with any generator set.
2. Provide one set Form C auxiliary contacts on both sides, operated by transfer switch position, rated 10 amps 250 VAC.
3. The transfer switch shall provide additional relay contacts to indicate the following conditions: Utility Source Available, load connected to Utility, Generator Source Available, load connected to Generator.

2.3 ENCLOSURE

A. Enclosures shall be UL listed NEMA 1 enclosures. The enclosure shall provide wire bend space in compliance to the latest version of NFPA70. The cabinet door shall include permanently mounted key type latches.

B. The cabinet shall provide code-required wire bend space at point of entry as shown on the drawings. Manual operating handles and all control switches (other than key-operated switches) shall be accessible to authorized personnel only by opening the key-locking cabinet door. Transfer switches with manual operating handles and/or non key-operated control switches located on outside of cabinet do not meet this specification and are not acceptable.

C. Note size and access requirements for the transfer switch (and associated equipment) and provide equipment that will fit into the space allowed and comply with code-specified access requirements.

2.4 BATTERY CHARGING

A. The transfer switch/generator set combination shall be provided with a battery charger for the generator set starting batteries. Refer to Generator Sets Specification Section 16231 for specific requirements. Supply power failed indication shall be displayed on the ATS control panel.

2.5 SEQUENCE OF OPERATION

A. Open Transition Sequence of Operation
1. Normal State:
   a. Transfer switch normally connects an energized utility power source (source 1) to loads and a generator set (source 2) to the loads when normal source fails. The normal position of the transfer switch is connected to source 1 (connected to the utility), and no start signal is supplied to the genset.
2. Normal Power Failure and Restoration:
   a. When the transfer switch senses a power failure on source 1, it shall complete a pre-programmed time delay start sequence, and then send a start signal to the generator set.

b. The generator set shall immediately start and accelerate to rated voltage and frequency.
c. The transfer system shall complete a programmable time delay sequence, and then transfer to source 2 by open transition. Generator set starting time and all time delays in the system are to be coordinated to allow the generator set to start and accept emergency loads within 10 seconds, unless specific exception is granted by the engineer.
d. On return of source 1 to acceptable voltage and frequency levels, the control system shall initiate a time delay retransfer sequence. On completion of the time delay sequence, The control system shall transfer loads back to source 1 in the reverse sequence to that which was used to connect loads to source 2.
e. If the generator set fails during this period and normal source is available, the transfer switch shall automatically reconnect the system loads to the normal service.
f. The transfer switch shall operate the generator set unloaded for a cooldown period, and then remove the start signal from the generator set.

3. Generator Set Exercise (Test) With Load Mode (Open Transition). The control system shall be configurable to test the generator set under load. In this mode, the transfer switch shall control the generator set in the following sequence:
a. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.
b. The transfer switch shall issue a compatible start command to the generator set as follows:
i. On generators rated 50kW and greater, the transfer switch shall cause the generator set to start and run at idle until it has reached normal operating temperature. When the generator set has reached normal operating temperature or after an adjustable time period (whichever is shorter), the control system shall accelerate the generator set to rated voltage and frequency.
ii. On generators rated less than 50kW, the generator set shall immediately start and accelerate to rated voltage and frequency.
c. When the control systems senses the generator set at rated voltage and frequency, it shall operate to connect the loads to the generator set by opening the normal source contacts, and closing the alternate source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.
d. The generator set shall operate connected to the load for the duration of the exercise period.
e. On completion of the exercise period, the transfer switch shall operate to connect the loads to the normal source by opening the alternate source contacts, and closing the normal source contacts a predetermined time period later. The timing sequence for the contact operation shall be programmable in the controller.
f. The transfer switch shall operate the generator set unloaded for a cooldown period, and then remove the start signal from the generator set.
g. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.
h. If the generator set fails during the exercise period and normal source is available, the transfer switch shall automatically reconnect the system loads to the normal service.

4. Generator Set Exercise (Test) Without Load Mode. The control system shall be configurable to test the generator set without transfer switch load connected. In this mode, the transfer switch shall control the generator set in the following sequence:
a. Transfer switch shall initiate the exercise sequence at a time indicated in the exercise timer program, or when manually initiated by the operator.
b. The transfer switch shall issue a compatible start command to the generator set as follows:

i. On generators rated 50kW and greater, the transfer switch shall cause the generator set to start and run at idle until it has reached normal operating temperature. When the generator set has reached normal operating temperature or after an adjustable time period (whichever is shorter), the control system shall accelerate the generator set to rated voltage and frequency.

ii. On generators rated less than 50kW, the generator set shall immediately start and accelerate to rated voltage and frequency.

c. When the control systems senses the generator set at rated voltage and frequency, it shall operate the generator set unloaded for the duration of the exercise period.

d. At the completion of the exercise period, the transfer switch shall remove the start signal from the generator set. If the normal power fails at any time when the generator set is running, the transfer switch shall immediately connect the system loads to the generator set.

PART 3 - EXECUTION

3.1 FACTORY TESTING

A. The transfer switch manufacturer shall perform a complete operational test on the transfer switch prior to shipping from the factory. A certified test report shall be submitted. Test process shall include calibration of voltage sensors.

3.2 SERVICE AND SUPPORT

A. The manufacturer of the transfer switch shall maintain service parts inventory at a central location which is accessible to the service location 24 hours per day, 365 days per year.

B. The transfer switch shall be serviced by a local service organization that is trained and factory certified in both generator set and transfer switch service. The supplier shall maintain an inventory of critical replacement parts at the local service organization, and in service vehicles. The service organization shall be on call 24 hours per day, 365 days per year and shall be located no more than 75 miles from the project site.

C. The manufacturer shall maintain model and serial number records of each transfer switch provided for at least 20 years.

D. After generator set installation, the generator set supplier shall conduct a complete operation, basic maintenance, and emergency service seminar for up to 5 persons employed by the facility owner. The seminar shall include instruction on operation of the transfer equipment, normal testing and exercise, adjustments to the control system, use of the PC based service and maintenance tools provided under this contract, and emergency operation procedures. The class duration shall be at least 4 hours in length, and include practical operation with the installed equipment.

3.3 WARRANTY

A. The automatic transfer equipment shall be warranted (by the generator supplier when a generator is supplied within the project) for a period of not less than 2 years from the date of commissioning against defects in materials and workmanship.

B. The warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.

END OF SECTION 16415

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DUNS Number:

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Mailing Address:

Address 1:

Address 2:

City:

State:

Zip Code:

Additional Information:

Employer Identification Number:

Total Number of Employees:

Parent Organization:

Administrator:

Organization Designation:

Employer Category:

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